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Hot Water and Your Home Energy Budget

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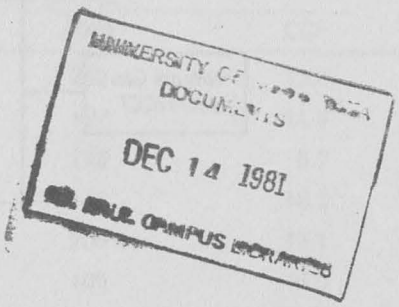


HOW MUCH ENERGY DO YOU USE FOR HOT WATER?

The amount of energy used for hot water in your home depends on the number of persons in your household, their water use habits, and the efficiency of the water heater. Chart 1 gives the amount of fuel consumed according to the amount of hot water used per week and the efficiency of the water heater.

Chart 1. Hot water fuel use

Type of water heater	Efficiency of heater	Fuel Consumed Per Year According to Gallons of Hot Water Used[1]		
		Low Use (300 gal/wk)	Average Use (450 gal/wk)	High Use (700 gal/wk)
Electric average efficiency model[2]	79%	4330 kWh/yr.	6490 kWh/yr.	8650 kWh/yr.
Electric most-efficient model[3]	97%	3500 kWh/yr.	5250 kWh/yr.	7000 kWh/yr.
Natural Gas average efficiency model[2]	48%	243 CCF/yr.	364 CCF/yr.	485 CCF/yr.
Natural Gas most-efficient model[3]	58%	200 CCF/yr.	300 CCF/yr.	400 CCF/yr.
Propane Gas average efficiency model[2]	48%	264 gal/yr.	396 gal/yr.	528 gal/yr.
Propane Gas most-efficient model[3]	58%	217 gal/yr.	326 gal/yr.	435 gal/yr.

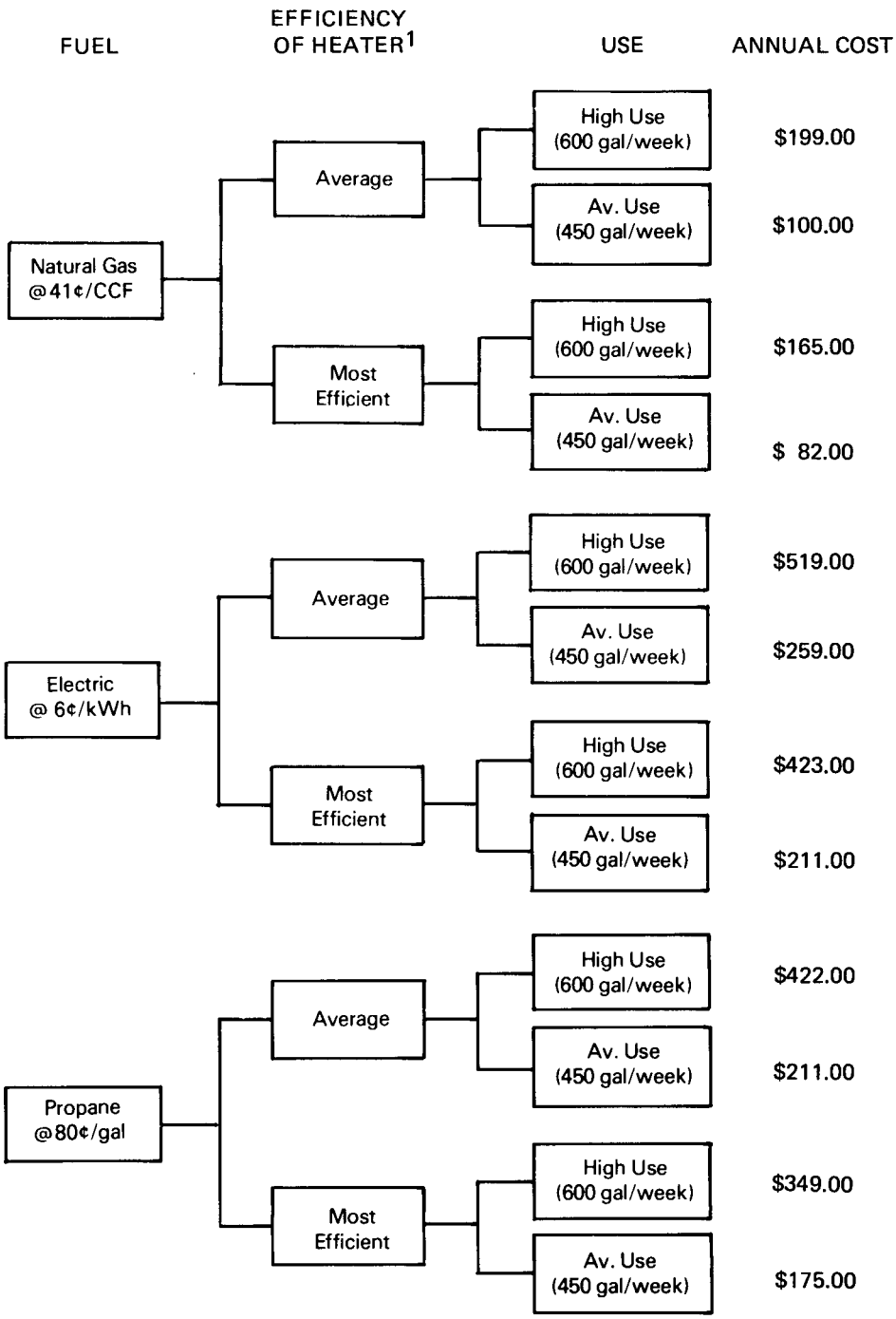
[1] *Assume 90°F temperature rise in hot water, e.g., 45°F to 135°F and 8.3 lbs./gallon.*
Energy purchased in BTU's $= \frac{\text{Temperature rise} \times \text{gal. of hot water} \times 8.3}{\text{efficiency of the water heater system}}$
1 kWh = 3,412 BTU
1 CCF = 1,000 BTU
1 gal. propane = 92,000 BTU

[2] *"Average" models have the average efficiency of all models sold in 1978. Source: Federal Register, June 30, 1980.*

[3] *"Most-efficient" models have the highest efficiency of all models available in January 1980. Heater efficiency and fuel usage were derived from data in the Federal Register, March 25, 1980.*

Chart 2 gives a quick comparison of costs due to hot water usage and efficiencies of new water heaters. Approximate annual costs are based on 1981 energy prices in the Minneapolis-St. Paul area as estimated by the Minnesota Energy Agency, Forecasting Division, 12/9/80. Some utilities offer lower rates if water is heated at off peak times.

Chart 2. Example results of annual hot water cost for water heated from 45°F to 135°F



[1] *Efficiencies as described in footnote 2 and 3, Chart 1.*

REDUCING THE GALLONS OF HOT WATER USED

The amount of hot water used can be reduced by eliminating uses, using the minimum amount for each purpose, using lower temperature water, and re-using heated water whenever possible. Chart 3 illustrates how simple changes in habits can make a difference in your utility bill.

Lowering the temperature setting of the water heater increases the total gallons of hot water drawn for mixed uses such as baths and showers. This may result in shortages of hot water if water needs are great for a short time period, or if your electric water heater heats only at off-peak hours. Gas water heaters have controls which can be easily set for low, normal, or high temperatures. Some new electric water heaters have exterior controls for easy adjustment of the temperature settings.

The appliance requiring the highest temperature water is the dishwasher. It operates most effectively if the water heater is set at normal (about 140°F.). Actual water temperature in the dishwasher is lower because there is some heat loss to the water pipes and to the interior of the dishwasher.

Chart 3. Annual estimated savings with changes in water use habits[1]

Habit change per week	Annual Savings		
	Gal. Hot Water	kWh	CCF
Eliminate one bath or 6-10 min. shower[2]	1040	232	13.4
Shorten one 6-10 min. shower to 1-1½ min.[2]	884	197	11.4
Use flow restrictor for one 6-10 min. shower[2]	520	116	5.7
Eliminate one dishwasher load[3]	780	174	10.1
Eliminate one laundry load in hot water[4]	936	209	12.1
Change one laundry load from hot to warm wash[5]	468	105	6.0

[1]Assume cold water at 45°F, hot water at 135°F, and water heating system efficiencies of 97 percent for electric and 58 percent for gas.

[2]One-half fill bath (2½ x 5 tub) or 6-10 min. shower - 30 gallons @ 105°F. 1-1½ min. shower - 4½ gallons @ 105°F.; a flow restrictor can reduce the water flow up to 50 percent.

[3]14 gallons

[4]18 gallons fill of hot water, cold water used in rinse.

[5]Warm settings usually use 50 percent hot and 50 percent cold water.

EFFICIENT WATER HEATERS

New water heaters have an energy label which indicates the annual estimated operating cost of the specific model. It also lists the lowest and highest operating costs of water heaters using the same fuel and with similar capacity according to the first-hour rating. This rating is the amount of water that can be heated and made available over the first-hour basis. The operating costs are based on laboratory tests designed to approximate typical usage (450 gallons of water per week and temperature rise of 90°F).

The efficiency of existing water heaters can be improved by using an insulation jacket which covers the sides and the top of electric water heaters, but only the sides of gas water heaters. Jackets can be used safely on gas water heaters, but the installation instructions must be followed *very carefully*, use only the specially designed jacket, *do not* use building insulation on gas water heaters.

Eliminating or minimizing the size of the water heater storage tank reduces the heat lost to the tank wall. Electric point-of-use water heaters are available with ½ gallon tanks and can be used if small amounts of heated water are needed at one time. The units available in the United States operate on 110-120 volts, conventional units operate on 220-240 volts. Gas tankless water heaters are available, the hot water output varies with the BTU/hr. rating of the burner and the temperature rise. There are no water heater temperature settings, the temperature of the water delivered is controlled by the flow-rate.

SOLAR WATER HEATERS

Chart 4 gives results from testing a solar water heater in Owatonna, Minnesota, from July, 1979 to June, 1980, (Courtesy of Steele-Waseca Cooperative Electric). The test system had 60 square feet of collector and a 120 gallon preheat/storage tank added to the existing electric water heater. A drain-down collector pipe loop, which drains the water in the collectors at night provided protection against freezing.

For further information on solar water heating, refer to extension folder 592 *Solar Options for Minnesota Homes: How to Choose a Good Investment.*

Chart 4. Solar water heater test (Steele-Waseca Cooperative Electric, Owatonna, MN)

		A	B	C	D	E	F	G
	Gallons Used Per Month	Days In Month	Gallons Per Day	W/O Solar Assist. Estimate of kWh Used (.24 kWh x gal.)	Actual kWh Used	kWh Saved (C-D)	¢ per kWh	$ Saved (E x F)
July '79	2366	31	76	567	253	314	.0535	16.80
Aug. '79	2847	31	92	683	512	171	.0587	10.04
Sept. '79	2619	30	87	629	311	318	.0584	18.57
Oct. '79	2553	31	82	612	405	207	.0595	12.32
Nov. '79	2531	30	84	607	446	161	.0665	10.71
Dec. '79	2723	31	88	653	477	176	.0615	10.82
Jan. '80	2597	31	84	623	497	126	.0570	7.18
Feb. '80	2242	29	77	538	329	209	.0614	12.83
Mar. '80	2775	31	90	666	401	265	.0592	15.69
Apr. '80	2856	30	95	685	382	303	.0590	17.88
May '80	2723	31	88	653	337	316	.0652	20.60
June '80	2472	30	82	593	309	284	.0744	21.13
TOTALS	31,304	366	1025	7509	4659	2850	.7343	$174.57
Average	2,609	30.5	85.4	626	388	237.5	.0612	$ 14.54

INITIAL INVESTMENT = $1,835 (1978 purchase, no installation cost)
12 month savings, July '79 thru June '80 = $174.57

$174.57 ÷ $1,835.00 = 9.5% return on investment

RETURN ON INVESTMENT WITH TAX CREDIT:
1978 Credit Allowed a Total of State and Federal = 30% on First $1,835 = $550.00 Tax Credit
$1,835.00 - $550.00 = $1,285.00 Actual Consumer Cost
$174.57 ÷ $1,285 = 13.6% Return on Investment

2850 kWh saved x 3,413 BTU/kWh = 9,727,050 BTU's collected during the most recent 12 months.

Total estimated savings from the installation date of August 28, 1978 to June 30, 1980, are $253.81.

$253.81 ÷ 22 months usage = $11.54 Average Savings Per Month.

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